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ABSTRACT

Information on how to conserve electrical energy in the home is provided in this module, which is recommended for sophomores in high school. Topics considered include electric meters, electric bills, costs, and conservation practices. Also included are several activities, sample problems to solve, four exercise sets (with answers), and a short list of references. (JN)

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Electrical Energy Conservation at Home

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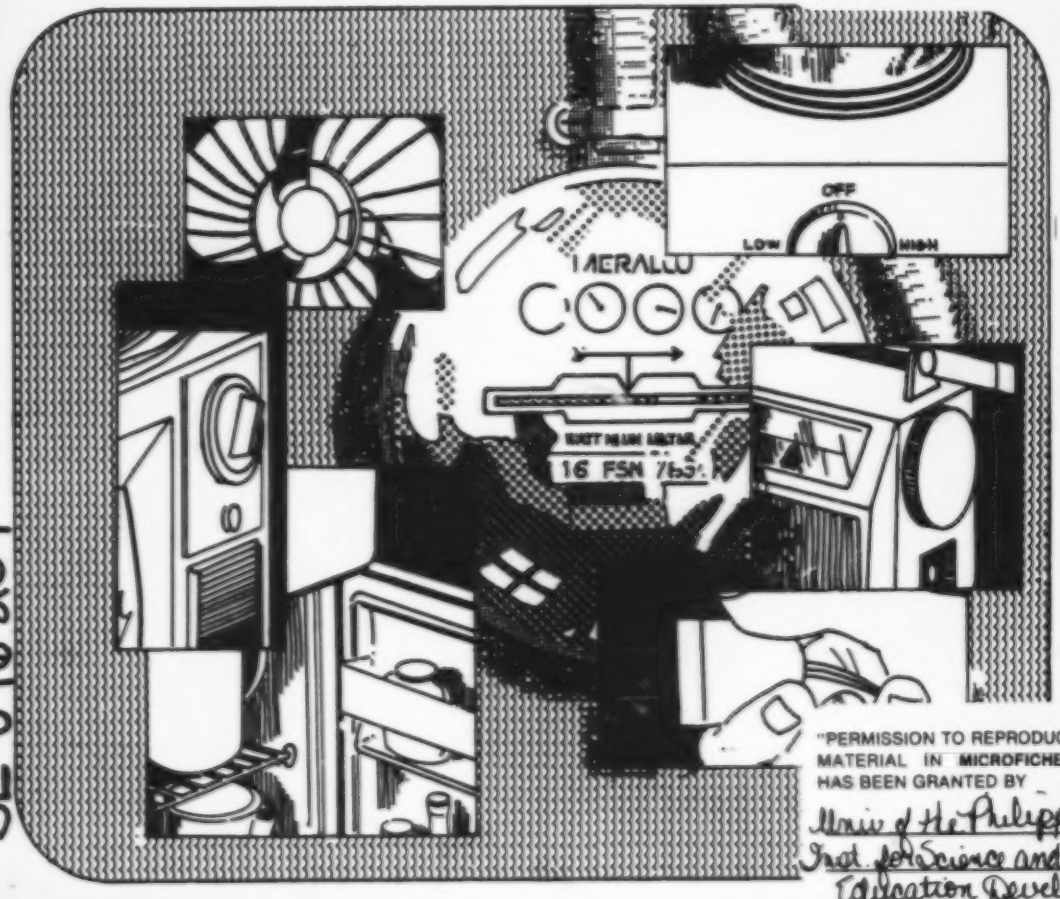

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Electrical Energy Conservation at Home

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ELECTRICAL ENERGY CONSERVATION AT HOME

Recommended Year Level: Second Year High School

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Electrical Energy Conservation at Home

Do you see that everything around us is changing and growing? You are growing too; plants around us are growing – our neighborhoods, our communities, our towns and cities are growing bigger each day. There are more people around us; more houses and buildings are being built, more cars, jeepneys and trucks, more roads and factories. And so, the population of our country has grown bigger. In 1939 there were only 16 million Filipinos. In 1980, our population is 48 million Filipinos.

We also see much progress around us. Inventions in science and technology have made life of the great number of people easier and more comfortable. We ride in cars, jeepneys and buses to go to school and to go to work. We cook food with electric stoves, keep them in refrigerators, listen to radios and watch TV's. We take elevators and escalators to go up and down in tall buildings. What makes all these possible? Electrical energy makes these machines work.

Do you know what will happen to you, your family and friends if we do not have enough electrical energy? Surely, we will have a hard and miserable life. But with our population growing bigger and bigger everyday, there is a danger that we will not have enough electrical energy for our use in the Philippines someday. To solve this problem, we should use electrical energy wisely. Let us learn to conserve energy. Do you want to know how?

Look at how the Reyes and Santos families use electrical energy.

In the figures below, we try to compare home practices of two families, Santos and Reyes families on their use of electrical energy. Which family uses electrical energy more wisely?

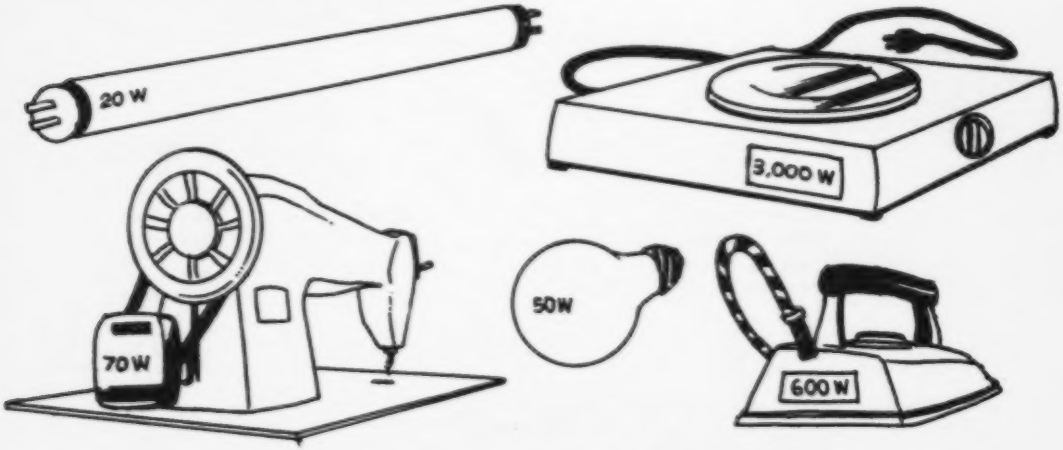
Santos Family

Reyes Family

Now answer the question which was asked earlier: Which family uses electrical energy more wisely? Does your family do the same? How?

We will now discuss ways in which we can save electrical energy at home. If we do all these we will pay less electric bill and yet enjoy a comfortable life with the use of our appliances and gadgets.

Electrical Energy, Electrical Power



Do you see the electrical appliances in the picture? In the appliances, you see the letter W. W stands for watts. A thousand watts is one kilowatt. The watt (W) or the kilowatt (kW) tells you the amount of electrical energy used per unit time. In other words, it tells you how fast electrical energy is used. This amount of electrical energy used per unit time is the *electrical power* of the appliance as shown in the equation –

$$\text{electrical power of an appliance} = \frac{\text{amount of electrical energy used by an appliance}}{\text{time of use}}$$

Therefore, the amount of electrical energy used by an appliance is given below:

$$\text{amount of electrical energy used by an appliance} = (\text{electrical power of an appliance}) \times (\text{time of use})$$

3

If you want to know how much electrical energy is used for a certain time, the equation , is,in terms of units,

watt × hour = watt – hour (Wh)

or kilowatt × hour = kilowatt – hour (kWh)

And since 1 kilowatt = 1 000 watts, then

1 kilowatt-hour = 1000 watt-hours

1 kWh = 1000 Wh

Example:

If the person above works 2 hours then

for the iron:	1000 watts × 2 hours	= 2 000 watt-hours
for the fan:	120 watts × 2 hours	= 240 watt-hours
Total energy used:		= 2 240 watt-hours or 2 240 Wh
		= 2.240 kilowatt-hours or 2.240 kWh

You will see that the electrical power of your gadget and the time you use it affect the amount of which you use. Therefore, it is clear to us that we should learn to regulate the use of our electrical appliances and gadgets. We have to learn to reduce the time for using our appliances. We also have to learn to use gadgets with lower electrical power.

Look at the example below. How do electrical power and time affect electrical energy? Find out in the following activities.

Activity 1. Describe your day-to-day activities at home that require the use of electrical energy. Begin from the time you wake up to the time you go to bed.

Activity 2. Name all electrical appliances or gadgets in your home. Prepare your own table like the example below. Show the electrical power or wattage of each, the approximate number of hours it is used daily, the estimated kilowatt-hours consumed per day, and the estimated kilowatt-hours used monthly.

After filling up your table, rank the appliances or gadgets according to the estimated kWh used monthly, from highest to lowest as in column G. What do you notice about the kWh used monthly when the wattage is high? When the number of hours of use is large?

Do you think you can use appliances with lower electrical power or watts? Can you also use these appliances less frequently?

Now write your own rule for saving electrical energy.

Electrical Appliance/ Gadget (A)	No. of Units (B)	Electrical Power or Wattage of Each Unit (C)	No. of Hrs. of Use Per Day (D)	Estimated Total kWh Consumed Per Day (E = B × C × D)	Estimated kWh Used Monthly (1 mo = 30 days (F = E × 30)	Rank (G)
fluorescent lamps	2	40W = 0.040 kW	7h	0.56 kWh	16.8 kWh	6
fluorescent lamps	1	10W = 0.010 kW	10h	0.10 kWh	3.0 kWh	8
incandescent bulbs	3	50W = 0.050 kW	4h	1.8 kWh	54.0 kWh	2
refrigerator	1	150W = 0.150 kW	24h	3.6 kWh	108 kWh	1
television	1	200W = 0.200 kW	6h	1.2 kWh	36 kWh	3
flat iron	1	1000W = 1 kW	0.5h	0.5 kWh	15kWh	7
electric fan	1	120W = .12 kW	8h	.96 kWh	28.8 kWh5	5
tape recorder	1	200W = .2 kW	5h	1.0 kWh	30.0 kWh	4

It is important to remember that electrical energy consumption or kWh used depends largely on the electrical power of the appliances or gadgets and the length of time they are used. This means that the

higher the electrical power of the appliances, the greater the consumption. Also, the longer the time they are used, the greater the consumption.

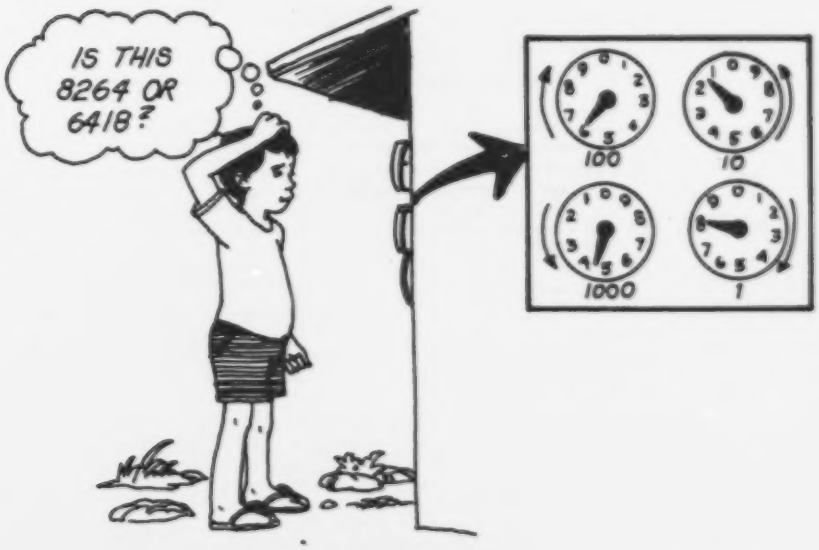
Reading Your Meter

Do you know how your consumption of electrical energy is measured? Have you taken a close look at your electric meter at home? How do you read an electric meter?

If you observe closely, your electric meter is read once a month. What happens when the man who reads the electric meter does not do his job well?

An electric meter is a device for measuring the amount of electrical energy or the number of kWh used by your household. You need to know how to read an electric meter so that you can watch out how much energy your family has used. You can also see whether the meter reader did a good job.

Below is a picture of an electric meter.



Do you see that the meter has four dials, each numbered from zero to nine? Let us call the dials as follows: the 1-dial, the 10-dial, the

100-dial, and the 1000-dial. The hands of the 1-dial and the 100-dial move clockwise while the hands of the 10-dial and the 1000-dial move counterclockwise.

To read a meter correctly we have to stand directly in front of it. When the hand of the 1-dial points directly to the number, for example "8", we read it as 8. But, we read it as 7 if the hand is between 7 and 8. We do the same in the reading of the 10, 100 and 1000 dials. If the hand of any dial is between two numbers, always read the lower number. Also, always start reading from the 1000-dial, then to 100, to 10 and lastly to 1-dial. Note that the reading on the meter on p. 6 is 4618. Let us see if you can do the following activities.

Activity 3. Locate your electric meter at home and observe closely how it works. Record its readings for 5 consecutive days. Find the difference between two readings by subtracting the previous reading from the present reading. For example, to find the difference in reading between day 1 and day 2, subtract the reading of day 1 from day 2. This will be the number of kWh used from day 1 to day 2.

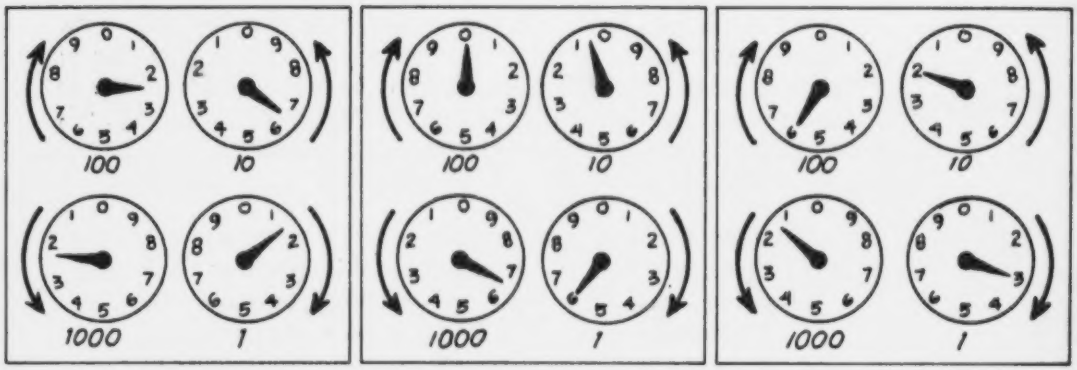
Day	Reading	Difference in Readings
1	_____	
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

What does the difference in readings show?

Activity 4. Compute the total number of kWh of the appliances and gadgets in Activity 2 for one month. Compare this number with your kWh consumption given in your notice of meter reading in the previous month. Are they the same? If not, what might have caused the difference?

Exercise Set 1

1. Record the reading on each of the following electric meters:



a. ☐☐☐☐ b. ☐☐☐☐ c. ☐☐☐☐

2. Draw the electric meter that show each of the following readings:

(a) 3746
(b) 8921
(c) 9876

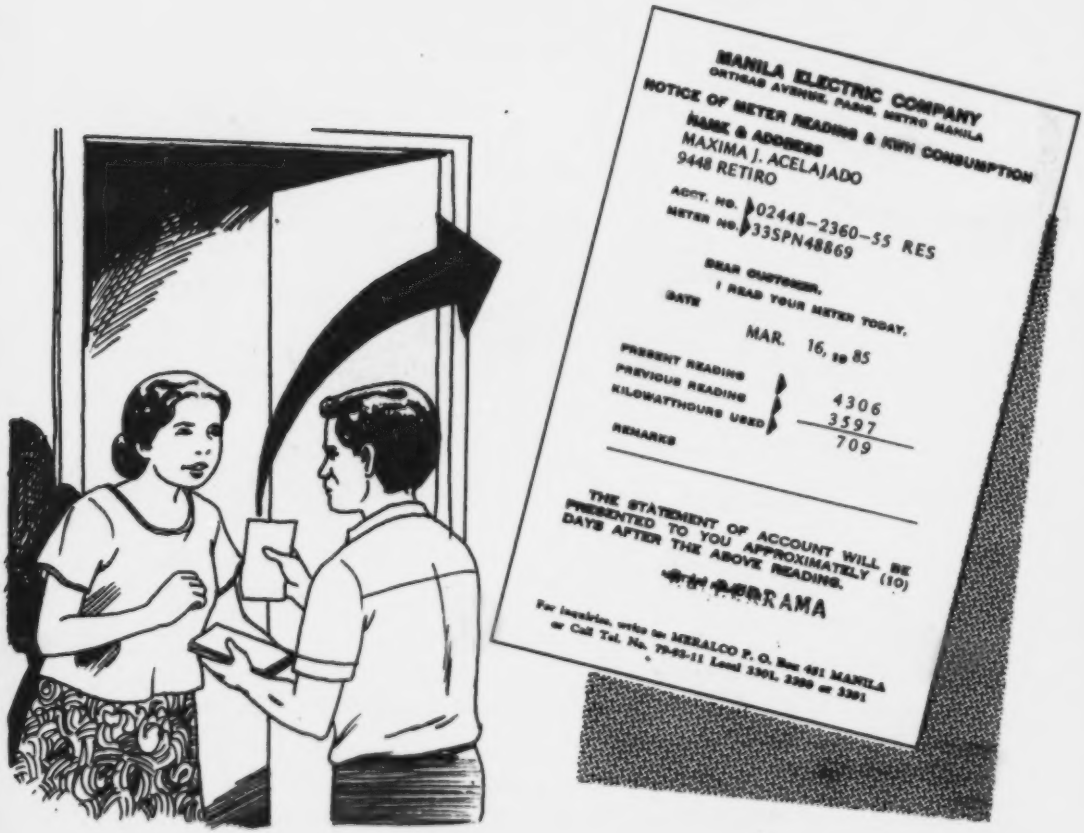
3. Given the electric meter readings for five consecutive months of a family, find the difference in readings by filling the blanks provided for below.

For the month of	Electric Meter Reading	No. of kWh Used
November	2746	
December	3001	_____
January	3219	_____
February	3387	_____
March	3504	_____
April	3629	_____

Your Electric Bill

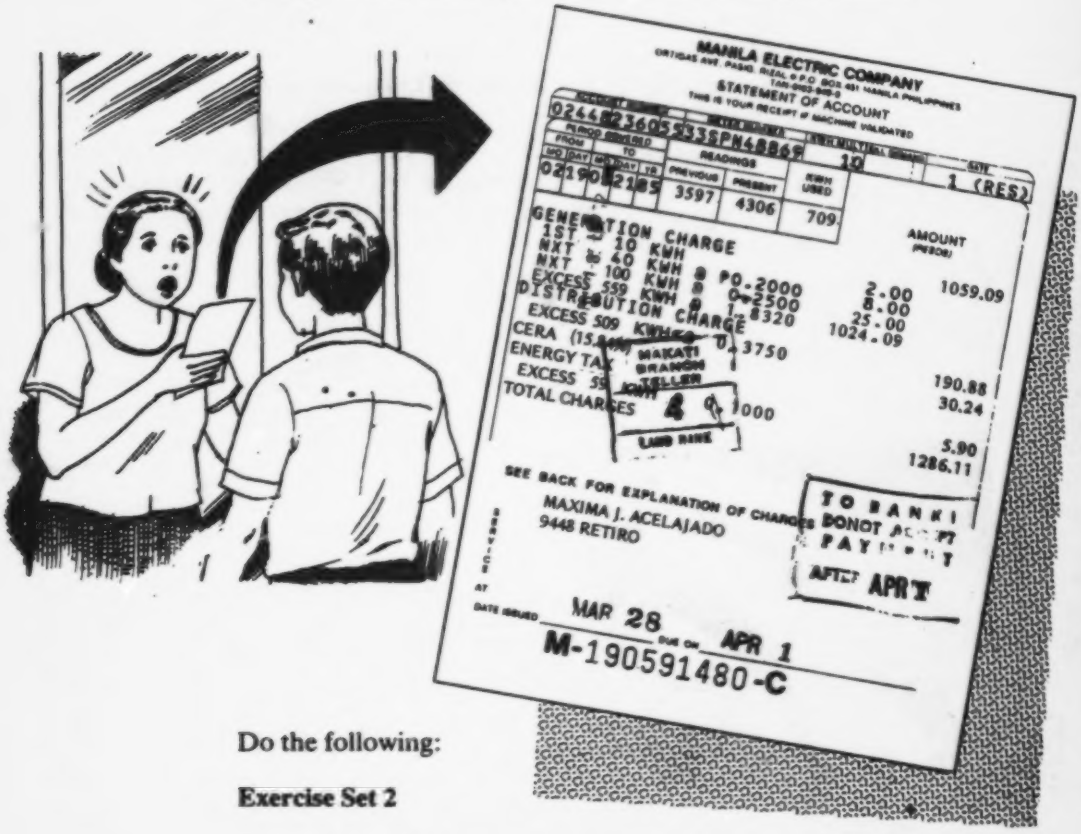
The National Power Corporation (NPC) supplies the oil used by electric plants which serves the different localities all over the country. For example, Meralco provides Metro Manila's electricity, the First Laguna Electric Cooperative provides the electricity needs of most towns in Laguna, the Cebu Electric Cooperative provides the electricity needs of Cebu, etc.

Each household or office is informed of its energy consumption every month. Notice of meter reading and kWh consumption is given to them about a week after the reading of their electric meter. Below is a sample of the notice.


MANILA ELECTRIC COMPANY
ORTIGAS AVENUE, PASIG, METRO MANILA
NOTICE OF METER READING & KWH CONSUMPTION
NAME & ADDRESS
MAXIMA J. ACELAJADO
9448 RETIRO
ACCT. NO. 02448-2360-55 RES
METER NO. 33SPN48869
DEAR CUSTOMER,
I READ YOUR METER TODAY.
DATE
MAR. 16, 19 85
PRESENT READING 4306
PREVIOUS READING 3597
KILOWATTHOURS USED 709
REMARKS
THE STATEMENT OF ACCOUNT WILL BE PRESENTED TO YOU APPROXIMATELY (10) DAYS AFTER THE ABOVE READING.
RAMA
For inquiries, write to MERALCO P. O. Box 451 MANILA or Call Tel. No. 79-93-11 Local 3301, 3309 or 3301

9

After this notice is given to the consumer a monthly statement of account is also sent. This statement informs the consumer of his kilowatt-hour consumption and the amount to be collected. Below is a sample of the monthly statement of account by Meralco.



Do the following:

Exercise Set 2

From the statement of account above, note that Miss Acelajado's household has to pay ₱1286.11 this month.

1. What was the previous reading?
2. What is the present reading?
3. How many kWh were consumed by the household?

Each electric company collects a fixed or *basic amount* from each costumer. But this basic amount is

good only if the consumption is not more than or not in excess of the minimum kWh level. That is, if the electric consumption is more than or in excess of the lowest allowed kWh or minimum, then the customer has to pay extra in addition to the basic amount.

The basic amount is the amount paid for the minimum kWh level limit. The table below shows the prescribed basic amount for the minimum kWh in some of the electric plants in our country.

Electric Plant	Minimum kWh Limit	Basic Amount	Amount in Excess of Minimum kWh
MERALCO (as of February, '85)	0- 10 11- 50 51-150	₱ 2.00 0.20/kWh 0.25 /kWh	₱0.375 is charged for each kWh over 200 kWh
CEBU ELECTRIC COOPERATIVE (as of December, '83)	0- 15	₱19.35	₱1.29 is charged for each kWh over 15 kWh
FIRST LAGUNA ELECTRIC COOPERATIVE (as of December, '83)	0- 20	₱23.60	₱1.18 is charged for each kWh over 15 kWh
DAVAO ELECTRIC COOPERATIVE (as of December, '83)	0- 15	₱ 7.80	₱0.52 is charged for each kWh over 15 kWh

Thus, the total basic amount is the sum of the basic amount and the added cost for the kWh consumed which is more than or in excess of the minimum kWh level limit. In other words,

Total basic amount = Basic amount + Amount for the kWh in excess of the minimum kWh

Now try to solve the following:

Sample Problems

1. A household in Laguna consumed 32 kWh for the month of November. How much was the total basic amount paid?

Solution:

First 20 kWh	₱23.60 (Basic Amount)
Excess over 20 kWh (32 kWh - 20 kWh = 12 kWh) 12 kWh × ₱1.18/kWh	14.16
Total Basic Amount	₱37.76

2. Mr. Lugtu paid ₱14.56 for the total basic amount of his household's electric bill. How many kWh was consumed if the household is in Davao Sur?

Solution:

₱7.80 from ₱14.56 is the basic amount for the firt 15 kWh. Therefore, ₱14.56 - ₱7.80 = ₱6.76 is the amount paid for the kWh in excess of 15 kWh.

₱6.76 ÷ ₱0.52/kWh = 13 kWh.

is then the number of kWh in excess of 15 kWh.

Hence, the household consumed a total of

15 kWh + 13 kWh or 28 kWh.

Extra Charges

Electric plants add extra charges so that consumers will not waste electrical energy. In Metro Manila, Meralco collects extra charges on those who consume more than 150 kWh a month. In the provinces, extra charges are collected on all households regardless of the number of kWh consumed.

The different kinds of extra charges are shown in the following table:

Meralco	Electric Cooperatives
1. *Currency Adjustment* – refers to the Currency Exchange Rate Adjustment (CERA). This depends on the increase or decrease of the exchange rate of peso to a U.S. dollar.	1. *Foreign Exchange Adjustment* (FOREX) – the counterpart of Meralco's CERA. It varies from one electric cooperative to another.
2. *Generation Charge (GC)* – is formerly called the Purchased Power Adjustment (PPA). This amount depends on the cost of oil per barrel. This is being prescribed by NPC. It varies every month.	2. *Fuel Cost Adjustment (FCA)* – the counterpart of Meralco's GC. Each cooperative has its own FCA.
3. *Energy Tax* – collected from those who consume more than 650 kWh.	3. None

The following table presents the rates of the extra charges of some electric plants in our country.

Electric Plant	kWh Limit	Extra Charges
Meralco	0 – 150	none
	151 – 650	CERA: 15.84% of basic amount in excess of 200 kWh (as of April, 1985) GC : P1.832/kWh (as of April, 1985)
	651 – up	CERA: 15.84% amount in excess of 200 kWh (as of April, 1985) GC : P1.832/kWh (as of April, 1985) Energy Tax: 651 – 1001 → P0.10/kWh 101 – 1500 → P35.00 + P0.20/kWh 1501 – up → P135.00 + P0.35/kWh
First Laguna Electric Cooperative	0-up	FCA : P0.258/kWh (as of December, 1983) FOREX: P0.098/kWh
Cebu Electric Cooperative	0-up	FCA : P0.258/kWh (as of December, 1983) FOREX: P0.098kWh
Davao Sur Electric Cooperative	0-up	FCA : P0.50/kWh (as of December, 1983) FOREX: P0.098/kWh

Exercise Set 3

Study again Miss Acelajado's household bill on p. 10.

1. What is the total basic amount paid?
2. How many kWh are given generation charge?
3. How many kWh are given energy tax?

In summary, for residential consumers the net bill depends on the number of kilowatt-hours used and is computed as follows:

Electric Plant	kWh Used (C)	Net Bill
Meralco	$C \leq 200$ kWh	Total Basic Amount
	150 kWh $< C \leq$ 650 kWh	Total Basic Amount + CERA + GC
	$C \geq 650$ kWh	Total Basic Amount + CERA + GC + Energy Tax
Electric Cooperatives	C	Total Basic Amount + FCA + FOREX

Activity 5. Using all appliances listed in Activity 2, make changes in time of use so that you will come up with a total of 150 kWh per month for those living in Metro Manila, and a total of 15-20 kWh (depending upon the minimum kWh level) for those living in the provinces.

Exercise Set 4

1. If a household in Metro Manila consumed 120 kWh of energy, how much would be the net bill?

2. In a certain locality, the bill paid by a household is ₱23.80. The minimum kWh level is 15. If the FCA amounted to ₱3.87 and the FOREX to ₱1.43,

   (a) how much is the basic amount?
   (b) how much is the FCA per kWh?
   (c) how much is the FOREX per kWh?

Electrical Energy Conservation

A wise consumer can prevent problems or energy crisis by conserving energy. He should not waste all forms of energy. This is done by proper care and use of machines that require electrical energy. He should arrange carefully his daily activities using energy at home and he should take proper care of the use of electrical appliances.

The government can solve energy crisis by the following:

1. More mines should be developed and explored
2. Water power should be used to generate energy
3. Geothermal energy should be explored
4. Coal should be used
5. Nuclear power should be used
6. There should be experiments on how to generate methane gas from waste

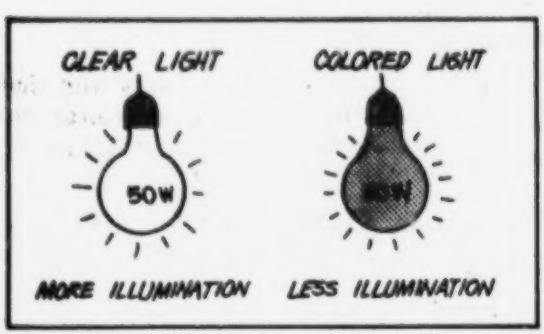
All citizens should help our government in solving our energy crisis by cutting down our energy consumption. Our job as citizens therefore, is to cooperate with our government in following the above.

We can reduce our electric bill by regulating the use of electrical appliances and gadgets. How can we do this?

Below are things to consider in the use of some electrical gadgets and appliances. Answer each question and show how it can help in the wise utilization and conservation of electrical energy.

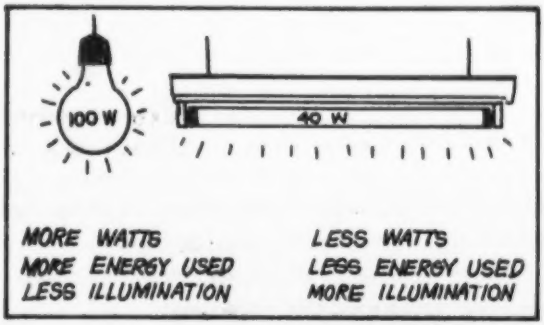
Take your list from Activity 3 and check yourself how many of the practices described below are in your list.

A. On Lighting



Use lights that give more illumination or brightness but consume less electrical energy

A 50-watt clear bulb gives more illumination than a 50-watt colored bulb. A colored bulb produces colored light; hence illumination is less.

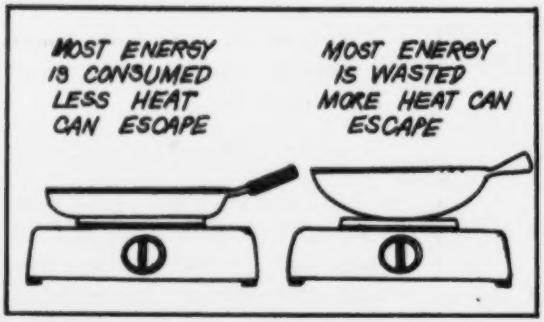


A 40-watt fluorescent tube will produce more light than a 100-watt incandescent bulb. An incandescent bulb produces greater heat than the fluorescent tube.

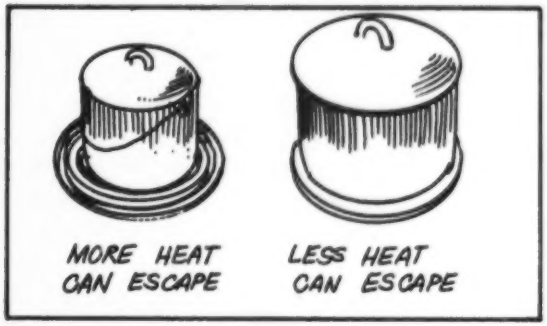
As much as possible, do your ironing, sewing, sports, etc. during daytime.

Activity 6. Name the places in your house which do not need lighting but are presently lighted. Give a plan of action in order to cut down consumption of electrical energy.

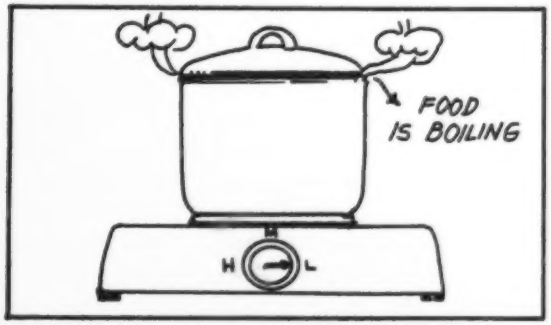
B. On Cooking



Use flat-botton pans with tight covers in cooking over an electric stove. This prevents escape of heat from the stove.

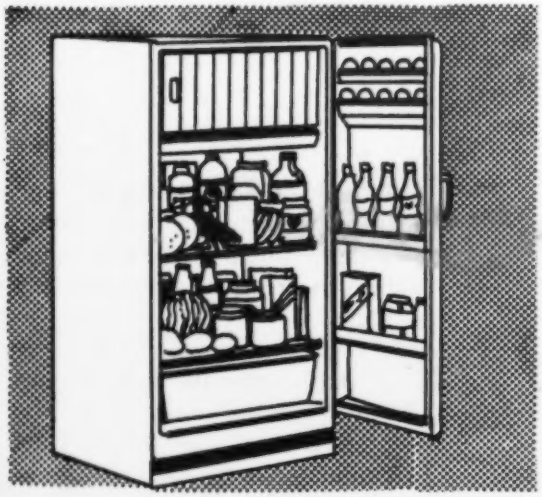


Avoid using a wide area of heating stove coil for a small pan.



Switch the electric stove to "low" when food starts to boil, and "off" the last few minutes of cooking.

C. On Refrigeration



Do not put too many things in your refrigerator. This interferes with air circulation and overworks the motor. Hence, more energy is consumed.

Avoid storing hot foods in the refrigerator. This increases the temperature inside the refrigerator, thereby increasing consumption.

Change door gaskets or seals of the refrigerator if there are leaks. Leaks cause warm air outside to enter the refrigerator thereby increasing the temperature inside. More energy is needed to cool or lower down the temperature again. This cycle goes on and on.

D. On Ironing Clothes

When you are almost through ironing, unplug the iron. There will be enough stored heat in the iron to press the few remaining items.

Avoid heating the iron for just one piece of clothing to be pressed. It wastes the heat accumulated in the iron.

As much as possible, do the hot job in the morning when it's cooler. It also avoids peak demands hours for electricity.

Avoid too much moisture on clothes. This requires longer hours of drying through the iron. This also lowers the temperature of the iron thus requiring more energy to maintain the temperature.

Activity 7. Name the other electrical appliances/gadgets that you have at home. Give the ways by which you can cut down the cost of consumption of electrical energy on them. You can easily calculate your kWh consumption if you know how to read your electric meter.

Electric plants have different ways of setting the basic rate and the extra charges. To avoid paying very high electric bills, you should learn about the minimum kWh level in your locality. With this minimum kWh level in mind, you can limit your consumption of electrical energy. Then you will have no problem in paying your electric bills.

Electrical appliances and gadgets with high wattage require a lot of electrical energy. As much as possible use electrical appliances with low wattage for lesser energy consumption.

The number of hours of use of appliances and gadgets also affect your consumption of electrical energy. To avoid high energy consumption, reduce the number of hours for using appliances and gadgets.

Also more energy is needed if appliances or gadgets are defective. Therefore, you should take good care of your appliances.

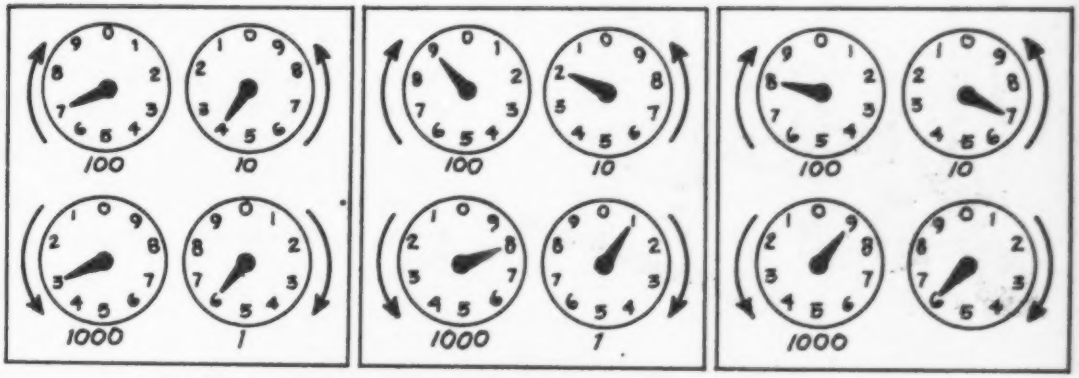
Let us all help our government conserve energy.

KEY TO EXERCISES

Exercise Set 1

1. a. 2261 b. 6006 c. 1623

2.



a. 3746 b. 8921 c. 9876

3. No. of kWh Used

255
218
168
117
125

Exercise Set 2

1. 3597
2. 4306
3. 709

Exercise Set 3

1. ₱225.88
2. 150 kWh
3. 59 kWh

Exercise Set 4

1. 120 kWh

0 – 10 →	2.00 = ₱ 2.00
11 – 50 → 40 × ₱0.20 =	8.00
51 – 120 → 80 × ₱0.25 =	20.00
	Net Bill = ₱30.00

2. a. ₱18.50
   b. ₱ 0.258/kWh
   c. ₱ 0.095/kWh

REFERENCES:

1. "Energy Conservation Pointers for Offices and Private Residences." MERALCO.

2. Manila Electric Company. How to Save on Your Electric Bill, 1983.

3. Metro Manila Enercon Guidelines. Monograph.

4. Philippine National Economic Development Authority. 1983 Philippine Statistical Yearbook.